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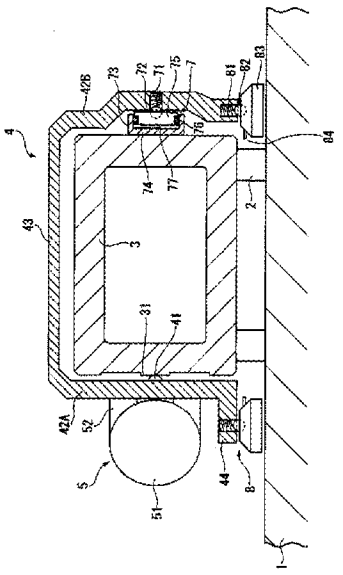
(54)【発明の名称】真直度測定装置

(57)【要約】

【課題】被測定物の鉛直面に対して水平方向の真直度を安定して測定することができる真直度測定装置を提供すること。

【解決手段】直定規３の被測定面３１延長方向に沿って移動可能に設けられ被測定面３１に接触する接触子４１を有するスライダ４と、スライダ４の移動方向に反射面を向けてスライダ４に取り付けられた反射鏡５と、スライダ４の移動方向から反射鏡５に向けて光を射出し、反射鏡５からの反射光を基に被測定面３１の真直度を測定するオートコリメータと、スライダ４の接触子４１が被測定面３１に一定の圧力で接するようにスライダ４を付勢する付勢手段７と、スライダ４の接触子４１が被測定面３１に接した状態を保持しつつスライダ４を被測定面３１の延長方向に沿って移動可能に支持する支持手段８とを備えている。

【選択図】　図３



【特許請求の範囲】
【請求項1】
定盤上に載置された状態において、前記定盤上面に対して略直交する鉛直面でかつ前記定盤上面に沿って略平行に伸びる被測定面を有する被測定物の真直度を測定する真直度測定装置であって、
前記被測定物の被測定面延長方向に沿って移動可能に設けられ前記被測定面に接触する接触子を有するスライダと、
前記スライダの移動方向に反射面を向けて前記スライダに取り付けられた反射鏡と、
前記スライダの移動方向から前記反射鏡に向けて光を射出し、前記反射鏡からの反射光を基に前記被測定面の真直度を測定するオートコリメータと、
前記スライダの接触子が前記被測定面に一定の圧力で接するように前記スライダを付勢する付勢手段と、
前記スライダの接触子が前記被測定面に接した状態を保持しつつ前記スライダを被測定面延長方向に沿って移動可能に支持する支持手段とを備えていることを特徴とする真直度測定装置。
【請求項2】
請求項１に記載の真直度測定装置において、
前記スライダは、被測定物の両側面に沿う一対の側部片および被測定物の上面に沿いかつ前記一対の側部片間を連結する上部片を有する形状に形成され、
前記一方の側部片に前記接触子が形成されているとともに、前記他方の側部片の前記接触子と対向する位置に前記付勢手段が設けられていることを特徴とする真直度測定装置。
【請求項3】
請求項２に記載の真直度測定装置において、
前記付勢手段は、前記被測定物の前記被測定面とは反対側面にエアーを吹き出すエアー吹出手段によって構成されていることを特徴とする真直度測定装置。
【請求項4】
請求項１～請求項３のいずれかに記載の真直度測定装置において、
前記支持手段は、前記定盤上面に対して前記スライダが所定高さ位置に保持されるように、前記スライダの下端部と前記定盤との間に設けられていることを特徴とする真直度測定装置。
【請求項5】
請求項４に記載の真直度測定装置において、
前記支持手段は、前記定盤上面にエアーを吹き出すエアー吹出手段によって構成されていることを特徴とする真直度測定装置。

【発明の詳細な説明】
【技術分野】
【0001】
本発明は、真直度測定装置に関する。
【背景技術】
【0002】
直定規は、測定面が水平および鉛直の２姿勢にて用いられ、水平面内および鉛直面内の真直度基準として、機械加工されたワークの仕上げ精度や、工作機械等の幾何運動精度の確認に用いられている。
その際、直定規の測定面が水平姿勢の場合と鉛直姿勢の場合とで測定面の真直度が異なるため、より高精度に厳密な基準として用いるには、それぞれの姿勢ごとに真直度を値付けする必要がある。
【0003】
従来、測定面が水平姿勢の場合、図４に示す測定法によって真直度が測定されている。定盤９１上にスペーサ９２を介して直定規９３を載置し、この直定規９３の上面側にある測定面（つまり被測定面９４）と接触する２つの接触子９５を有するスライダ９６を、被

測定面９４に沿って図４の紙面と直交する方向へ移動可能に設ける。スライダ９６上に取り付けられた反射鏡９７と対向する位置に配置されたオートコリメータ（図示省略）から反射鏡９７に対して検出光を射出し、反射鏡９７からの反射光を基に被測定面９４の真直度を測定する。

この測定法の場合、被測定面９４の上にスライダ９６を移動可能に載置した構成のため、スライダ９６の自重によって接触子９５が被測定面９４に一定圧で押し付けられるため、安定した測定を行うことができる。

【0004】

測定面が鉛直姿勢の場合、図５に示す測定法によって真直度が測定されている。スライダ９６の接触子９５を直定規９３の鉛直測定面（つまり被測定面９４）に当接させ、この状態でスライダ９６を被測定面９４に沿って移動させながら、前述と同様な方法によって被測定面９４の真直度を測定する。

この測定法の場合、スライダ９６を直定規９３の被測定面９４に押し付けながら測定しなければならないため、被測定面９４と接触子９５との接触圧が押し付け力によって変動しやすく、無管理状態であるため、安定した測定を行うことが困難であった。

【0005】

ところで、鉛直方向に設けた測定穴の真直度を測定するための装置として、縦型真直度測定装置が提案されている（例えば、特許文献１）。

この特許文献１に記載の装置では、上方からワイヤによって吊り下げられたミラー付き測定駒を、クイル穴よりもやや小径の円筒形状で、ミラー付き測定駒を挿入する部分が略コ字状に欠けているガイドバと一緒にクイル穴に挿入し、上方からオートコリメータによる検出光をミラー付き測定駒に対して射出し、ミラーからの反射光を検出しつつ、ミラー付き測定駒をクイル穴内の被測定面上を昇降させて真直度を測定する。この際、ミラー付き測定駒を被測定面に密着させるために、ガイドバに備え付けられた押圧具に、クイル穴における被測定面と反対側の内壁を押圧させ、それによってガイドバとミラー付き測定駒とを被測定面側に付勢させるという手段をとっている。

【0006】

【特許文献1】実開平５－６６５１２号公報

【発明の開示】

【発明が解決しようとする課題】

【0007】

しかしながら、このような特許文献１では、定盤に対して鉛直方向に被測定面を有する被測定物に対して、被測定物の鉛直方向の真直度は測定できるが、鉛直方向と直行する方向の真直度の測定は不可能である。

【0008】

本発明の目的は、被測定物の鉛直面に対して水平方向の真直度を安定して測定することができる真直度測定装置を提供することである。

【課題を解決するための手段】

【0009】

本発明の真直度測定装置は、定盤上に載置された状態において、前記定盤上面に対して略直交する鉛直面でかつ前記定盤上面に沿って略平行に伸びる被測定面を有する被測定物の真直度を測定する真直度測定装置であって、前記被測定物の被測定面延長方向に沿って移動可能に設けられ前記被測定面に接触する接触子を有するスライダと、前記スライダの移動方向に反射面を向けて前記スライダに取り付けられた反射鏡と、前記スライダの移動方向から前記反射鏡に向けて光を射出し、前記反射鏡からの反射光を元に前記被測定面の真直度を測定するオートコリメータと、前記スライダの接触子が前記被測定面に一定の圧力で接するように前記スライダを付勢する付勢手段と、前記スライダの接触子が前記被測定面に接した状態を保持しつつ前記スライダを被測定面延長方向に沿って移動可能に支持する支持手段とを備えていることを特徴とする。

【0010】

このような構成において、スライダを被測定物の被測定面に沿って移動、つまり、定盤に対して水平方向へ移動させる。各移動位置において、オートコリメータから検出光を反射鏡に向けて射出すると、その光は反射鏡によって反射され、オートコリメータに受光されるから、その反射光を基に、被測定物の被測定面の真直度を測定することができる。

本発明では、付勢手段によって、スライダの接触子が被測定面に一定の圧力で接するようにスライダが付勢されているから、スライダの接触子と被測定面との接点に常に一定の圧力がかかった状態でスライダを被測定物の被測定面に沿って移動させることができる。したがって、被測定面が定盤上面に対して略直交する鉛直面であっても、スライダの接触子と被測定面との接点に常に一定の圧力がかかった状態で測定できるから、その被測定面の水平方向の真直度を安定して高精度に測定できる。

しかも、支持手段によって、スライダの接触子が被測定面に接した状態に保持された状態で、スライダが被測定面延長方向に沿って移動可能に支持されているから、付勢手段による付勢力を大きくしなくてもよい。つまり、スライダの接触子が被測定面の所望位置に接した状態を保持するために、スライダの接触子と被測定面との接点圧力を大きくしなくてもよいから、この点からも、被測定面の水平方向の真直度を安定して高精度に測定できる。

【0011】

本発明の真直度測定装置では、被測定物の両側面に沿う一対の側部片および被測定物の上面に沿いかつ前記一対の側部片間を連結する上部片を有する形状に形成され、前記一方の側部片に前記接触子が形成されているとともに、前記他方の側部片の前記接触子と対向する位置に前記付勢手段が設けられていることが好ましい。

この発明によれば、接触子と付勢手段とが被測定物を挟んで対向位置に配置されているから、被測定物に対してスライダが回転するような力が発生することがない。よって、測定作業中にスライダが傾いたりせず、安定して測定を行うことができる。

【0012】

本発明の真直度測定装置では、前記付勢手段は、前記被測定物の前記被測定面とは反対側面にエアーを吹き出すエアー吹出手段によって構成されていることが好ましい。

この発明によれば、付勢手段にエアー吹出手段を用いたので、付勢手段と被測定物とは非接触であるから、摩擦等の測定誤差の要因を排除することができる上に、接触による部材の損傷等も防ぐことができる。

【0013】

本発明の真直度測定装置では、前記支持手段は、前記定盤上面に対して前記スライダが所定高さ位置に保持されるように、前記スライダの下端部と定盤との間に設けられていることが好ましい。

この発明によれば、スライダの下端部と定盤との間に支持手段を備えることで、被測定物に対して、スライダの自重がかからないようにすることができ、被測定物に負荷がかからず、変形、損傷といった測定精度を下げる要因を排除することができる。

【0014】

本発明の真直度測定装置では、前記支持手段は、前記定盤上面にエアーを吹き出すエアー吹出手段によって構成されていることが好ましい。

この発明によれば、支持手段をエアー吹出手段によって構成することで、定盤と支持手段とが空気膜を介して非接触となり、スライダを移動させる際に定盤と支持手段との間で摩擦を生まず、測定精度を向上させることができる。

【発明を実施するための最良の形態】

【0015】

以下、本発明の実施形態を図面に基づいて説明する。

図１～図３には被測定物である直定規３の真直度を測定する真直度測定装置が示されている。

直定規３は、定盤１上にスペーサ２を介して載置された状態において、断面が矩形枠状で、定盤１上面に沿って略平行に伸びる中空柱形状に形成され、その断面矩形枠状の一外

側面に被測定面３１を備える。被測定面３１は、定盤１に対して略直交する鉛直面で、かつ定盤１上面に沿って略平行に伸びている。

【0016】

真直度測定装置は、直定規３の被測定面３１延長方向に沿って移動可能に設けられ被測定面３１に接触する接触子４１を有するスライダ４と、スライダ４の移動方向に反射面を向けてスライダ４に取り付けられた反射鏡５と、スライダ４の移動方向から反射鏡５に向けて光を射出し、反射鏡５からの反射光を基に被測定面３１の真直度を測定するオートコリメータ６と、スライダ４の接触子４１が被測定面３１に一定の圧力で接するようにスライダ４を付勢する付勢手段７と、スライダ４の接触子４１が被測定面３１に接した状態を保持しつつスライダ４を被測定面３１の延長方向に沿って移動可能に支持する支持手段８とを備えている。

【0017】

スライダ４は、直定規３の両側面に沿う一対の側部片４２Ａ，４２Ｂと、直定規の上面に沿いかつ一対の側部片４２Ａ，４２Ｂ間を連結する上部片４３と、側部片４２Ａの端部から外側へ直角にかつ定盤１と平行に折り曲げられた底部片４４とを備えている。側部片４２Ａの内面側には、半球状の２つの接触子４１が被測定面３１の延長方向に一定間隔離れて設けられている。

【0018】

反射鏡５は、鏡面部を有する鏡５１と、鏡５１をスライダ４に取り付けるための取り付け部５２とを備えている。鏡５１は、側部片４２Ａの外面側において、２つの接触子４１の略中間位置に取り付けられている。

【0019】

オートコリメータ６は、鏡５１と対向する位置に配置され、鏡５１に向けて出力部（図示省略）から検出光を射出し、鏡５１からの反射光を検出部（図示省略）で受光し、被測定面３１の真直度を求める。

【0020】

付勢手段７は、側部片４２Ｂに螺合された調整ねじ７１と、調整ねじ７１の先端に設けられた球面軸受７２と、調整ねじ７１に球面軸受７２を介して揺動可能に取り付けられた付勢用エアベアリング７３とを備えている。付勢用エアベアリング７３は、シリンダ７４と、このシリンダ７４にピストンリング７６を介して摺動可能に収納されたピストン７５とを備えている。シリンダ７４とピストン７５との間に形成されたチャンバ７７には、圧縮空気が溜められているとともに、シリンダ７４の直定規３との対向面には空気噴出孔（図示省略）が形成されている。これにより、チャンバ７７内の圧縮空気が空気噴出孔から直定規３に向けて噴出され、直定規３との間に空気膜が形成されている。

【0021】

支持手段８は、側部片４２Ｂの定盤１との対向面に１つ、底部片４４の定盤１との対向面に２つ設けられている。これらの支持手段８は、側部片４２Ｂおよび底部片４４に螺合された調整ねじ８１と、調整ねじ８１の先端に設けられた球面軸受８２と、調整ねじ８１に球面軸受８２を介して取り付けられた支持用エアベアリング８３とを備える。支持用エアベアリング８３は、内部に圧縮空気を溜めておくためのチャンバ（図示省略）が形成されているとともに、定盤１との対向面に空気噴出孔（図示省略）が形成されている。チャンバへは給気孔８４から空気が取り込まれている。これにより、チャンバ内の圧縮空気が空気噴出孔から定盤１に向けて噴出され、定盤１との間に空気膜が形成されている。

【0022】

このような構成からなる真直度測定装置は、オートコリメータ６が鏡５１と対向する位置から鏡５１に向けて検出光を射出し、鏡５１に反射して戻ってきた反射光を検出する。この状態で、直定規３に対して２つの接触子４１を被測定面３１に接触させたままスライダ４をスライドさせ、スライドに伴う反射光の傾斜から真直度の測定を行う。

【0023】

このような本実施形態によれば、次の効果を奏することができる。

（１）付勢手段７によって、スライダ４の接触子４１が被測定面３１に一定の圧力で接するようにスライダ４が付勢されているから、スライダ４の接触子４１と被測定面３１との接点に常に一定の圧力がかかった状態でスライダ４を直定規３の被測定面３１に沿って移動させることができる。したがって、被測定面３１が定盤１上面に対して略直交する鉛直面であっても、スライダ４の接触子４１と被測定面３１との接点に常に一定の圧力がかかった状態で測定できるから、その被測定面３１の水平方向の真直度を安定して高精度に測定できる。

【0024】

（２）支持手段８によって、スライダ４の接触子４１が被測定面３１に接した状態に保持された状態で、スライダ４が被測定面３１延長方向に沿って移動可能に支持されているから、付勢手段７による付勢力を大きくしなくてもよい。つまり、スライダ４の接触子４１が被測定面３１の所望位置に接した状態を保持するために、スライダ４の接触子４１と被測定面３１との接点圧力を大きくしなくてもよいから、被測定面３１の水平方向の真直度を安定して高精度に測定できる。

【0025】

（３）接触子４１と付勢手段７とが直定規３を挟んで対向位置に配置されているから、直定規３に対してスライダ４が回転するような力が発生することがない。よって、測定作業中にスライダ４が傾いたりせず、安定して測定を行うことができる。

【0026】

（４）付勢用エアベアリング７３と直定規３とは非接触であるから、摩擦等の測定誤差の要因を排除することができる上に、接触による部材の損傷等も防ぐことができる。

【0027】

（５）スライダ４の定盤１と対向する面に支持手段８を備えることで、直定規３に対してスライダ４の自重がかからないようにすることができ、直定規３に負荷がかからず、変形、損傷といった測定精度を下げる要因を排除することができる。

（６）支持用エアベアリング８３を用いることで、定盤１と支持用エアベアリング８３とが空気膜を介して非接触となり、スライダ４を移動させる際に定盤１と支持手段８との間で摩擦を生まず、測定精度を向上させることができる。

【0028】

（７）スライダ４の定盤１と対向する面に調整ねじ８１を備えることで、接触子４１と被測定面３１との高さを合わせることができる。

【0029】

なお、本発明は前述の実施形態に限定されるものではなく、本発明の目的を達成できる範囲での変形、改良等は本発明に含まれるものである。

例えば、本実施形態において、反射鏡５は、側部片４２Ａの外周部に取り付けられているが、オートコリメータ６と対向する位置で検出光を反射することができれば、スライダ４のどの位置に取り付けても構わない。

また、付勢手段７として付勢用エアベアリング７３を使用しているが、代わりにばね等を使用して付勢しても構わない。

【0030】

また、付勢手段７は、付勢用エアベアリング７３が１つ設けられているが、接触子４１を被測定面３１側に付勢させることができれば、例えば、２つ、３つ等といった数の付勢用エアベアリング７３が設けられていても構わない。

また、接触子４１は、２箇所に計２つ設けられているが、例えば１本の棒形状で被測定面３１と接触するものでも構わないし、３つ以上で被測定面３１と接触するものでも構わない。

【0031】

また、スライダ４は、直定規３の形状に合わせて略コ字形状であるが、被測定物の形状に合わせて、例えば、略円形状や、略三角形状等であっても構わない。

また、支持手段８は、支持用エアベアリング８３を備えているが、代わりに、底部片４

４および側部片４２Ｂに定盤１上面を転動する車輪やコロ、ローラ等を設けてもよい。
　また、支持手段８は、定盤１と側部片４２Ｂおよび底部片４４とが対向する面に設けられているが、この位置でなくとも、例えば、直定規３の上面と対向する上部片４３にエアベアリングやローラ、車輪などを設けても構わない。

【産業上の利用可能性】

【0032】

　本発明は、直定規やゲージ、または加工処理されたワーク等の真直度を測定する形状測定器などに利用することができる。

【図面の簡単な説明】

【0033】

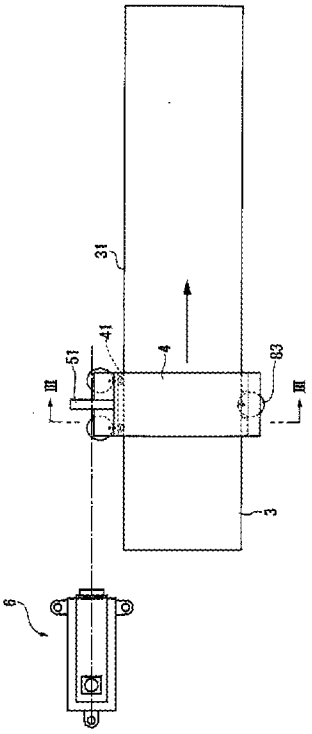
【図1】本発明の実施形態を示す全体図である。
【図2】本発明の実施形態を示す側面図である。
【図3】図１におけるＩＩＩ－ＩＩＩ線断面図である。
【図4】従来技術の測定法（水平物の測定法）を示す図である。
【図5】従来技術の測定法（鉛直面の測定法）を示す図である。

【符号の説明】

【0034】

１…定盤
２…スペーサ
３…直定規
４…スライダ
５…反射鏡
６…オートコリメータ
７…付勢手段
８…支持手段
３１…被測定面
４１…接触子
４２Ａ…側部片
４２Ｂ…側部片
４３…上部片
７３…付勢用エアベアリング
８３…支持用エアベアリング

【図1】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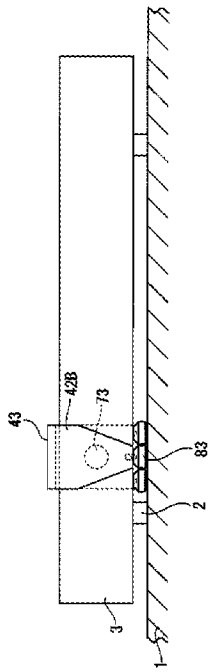
41
51
4
83
III
III
3
6

【図2】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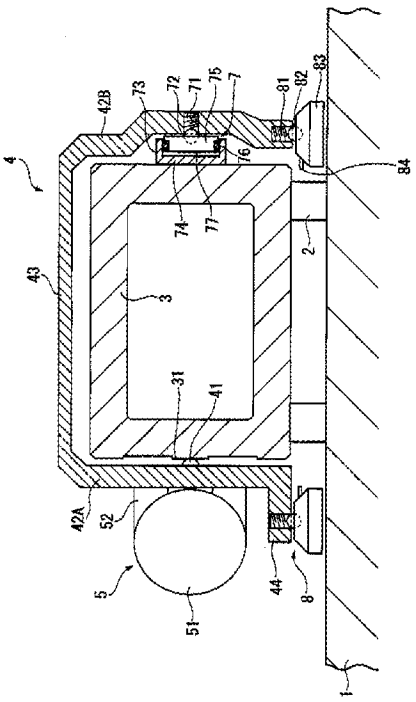
83
2
3
1

【図3】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42B
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72
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75
7
81
82
83
84
76
74
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2
43
3
31
41
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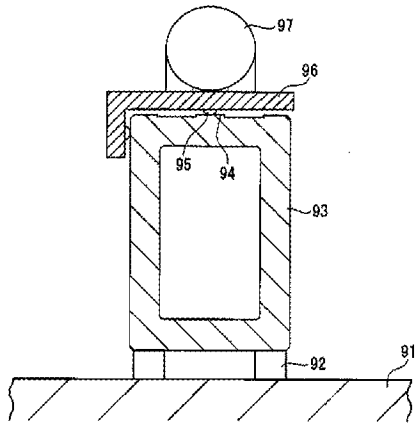
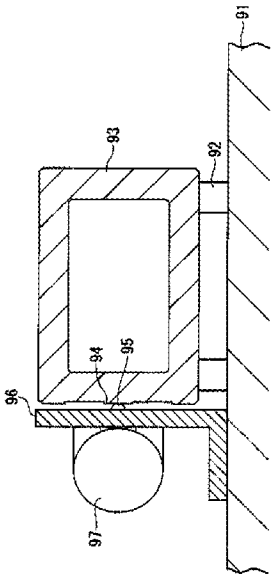
1

【図4】


97
96
95
94
93
92
91

【図5】



PATENT ABSTRACTS OF JAPAN

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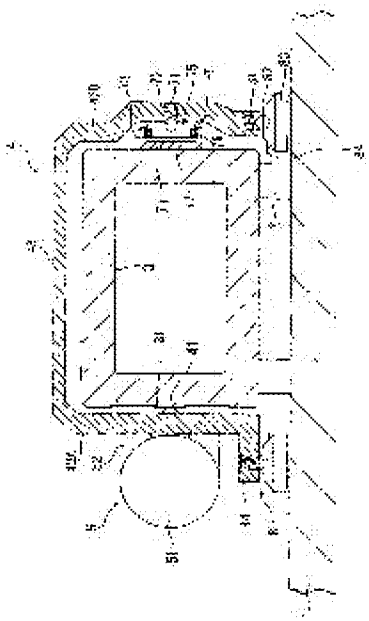
(72)Inventor : SAKAI HISAYOSHI

(54) MEASURING APPARATUS FOR PERPENDICULARITY

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a measuring apparatus for perpendicularity which can measure stably perpendicularity of the horizontal direction against the vertical plane of measured object.

SOLUTION: The measuring apparatus for perpendicularity is equipped with a sliding block 4 with a contact shoe 41 in contact with the measured plane 31, which is settled movably along an extended direction of the measured plane 31 of a straightedge 3, a reflecting mirror 5 installed on the sliding block 4 aiming a reflecting surface at the moving direction of the sliding block 4, an autocollimator measuring perpendicularity of the measured plane 31 based on reflected light from the reflecting mirror 5 that is emitted from moving direction of the sliding block 4 into the reflecting mirror 5, an energizing unit 7 energizing the sliding block 4 so as to force the contact shoe 41 of the sliding block 4 to come into contact with the measured plane 31 at a constant pressure, and a supporting unit 8 supporting the sliding block 4 to be movable along the extended direction of the measured plane 31, keeping the contact condition between the contact shoe 41 of the sliding block 41 and the measured plane 31.



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CLAIMS

[Claim(s)]
[Claim 1]
In the state where it was laid on a surface plate, it is a straightness measuring apparatus which measures a straightness of a device under test which has a measured plane which is a vertical plane which abbreviated-intersects perpendicularly to said top face of surface plate, and is extended to abbreviated parallel along said top face of surface plate,
A slider which has contact which is provided movable along a measured plane extending direction of said device under test, and contacts said measured plane,
A reflector which turned a reflector in the move direction of said slider, and was attached to said slider,
An autocollimator which ejects [of said slider] light from movement towards said reflector, and measures a straightness of said measured plane based on catoptric light from said reflector,
An energizing means which energizes said slider so that contact of said slider may touch said measured plane by a fixed pressure,
A straightness measuring apparatus provided with a support means contact of said slider supports said slider movable along a measured plane extending direction holding the state where said measured plane was touched.
[Claim 2]
In the straightness measuring apparatus according to claim 1,
Said slider is formed in shape which has a top piece which connects between a piece of a flank of said couple over a piece of a flank of a couple and the upper surface of a device under test in alignment with both side surfaces of a device under test,
A straightness measuring apparatus while said contact is formed in said one piece of a flank, wherein said energizing means is provided in said contact of a piece of a flank of said another side, and a position which counters.

[Claim 3]
In the straightness measuring apparatus according to claim 2,
A straightness measuring apparatus, wherein said energizing means is constituted by an air blow-off means which blows off air to an opposite side face with said measured plane of said device under test.
[Claim 4]
In the straightness measuring apparatus according to any one of claims 1 to 3,
A straightness measuring apparatus, wherein said support means is established between a lower end part of said slider, and said surface plate so that said slider may be held to said top face of surface plate in a prescribed height position.
[Claim 5]
In the straightness measuring apparatus according to claim 4,
A straightness measuring apparatus, wherein said support means is constituted by an air blow-off means which blows off air to said top face of surface plate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to a straightness measuring apparatus.
[Background of the Invention]
[0002]
A measuring plane is used with two horizontal and vertical postures, and straight edge ruler is used for the check of the finishing accuracy of the machined work, and geometric movement accuracy, such as a machine tool, as a straightness standard in the level surface and a vertical plane.
Since the straightnesses of a measuring plane differ by the case where they are a case where the measuring plane of straight edge ruler is a horizontal position, and a vertical attitude, in that case, in order to use as a stricter standard to high degree of accuracy, it is necessary to make a market a straightness for every posture.
[0003]
Conventionally, when a measuring plane is a horizontal position, the straightness is measured by the measuring method shown in drawing 4. The straight edge ruler 93 is laid via the spacer 92 on the surface plate 91, and the slider 96 which has two contact 95 in contact with the measuring plane (that is, measured plane 94) in the upper surface side of this straight edge ruler 93 is formed in the direction which intersects perpendicularly with the space of drawing 4 along the measured plane 94 movable. Detection light is ejected from the reflector 97 attached on the slider 96, and the autocollimator (graphic display abbreviation) arranged at the position which counters to the reflector 97, and the straightness of the measured plane 94 is measured based on the catoptric light from the reflector 97.
Since contact 95 is forced on the measured plane 94 by prudence of the slider 96 with

constant pressure for the composition which laid the slider 96 movable on the measured plane 94 in the case of this measuring method, stable measurement can be performed.

[0004]

When a measuring plane is a vertical attitude, the straightness is measured by the measuring method shown in drawing 5. The straightness of the measured plane 94 is measured by the same method as the above-mentioned, making contact 95 of the slider 96 contact the perpendicular measuring plane (that is, measured plane 94) of the straight edge ruler 93, and moving the slider 96 along the measured plane 94 in this state.

In order to have to measure in the case of this measuring method, forcing the slider 96 on the measured plane 94 of the straight edge ruler 93, the contact pressure of the measured plane 94 and contact 95 was easily changed according to pressure, and since it was a non-controlled state, it was difficult to perform stable measurement.

[0005]

By the way, the vertical mold straightness measuring apparatus is proposed as a device for measuring the straightness of the measuring hole provided in the perpendicular direction (for example, patent documents 1).

In a device given in these patent documents 1, the measurement piece with a mirror hung from the upper part with the wire from a quill hole with the cylindrical shape of mist or a byway. The portion which inserts a measurement piece with a mirror inserting in a quill hole together with the guide bar which lacks in the approximately U shape, ejecting the detection light by an autocollimator from the upper part to a measurement piece with a mirror, and detecting the catoptric light from a mirror. You make it go up and down a measurement piece with a mirror on the measured plane in a quill hole, and a straightness is measured. Under the present circumstances, in order to stick a measurement piece with a mirror to a measured plane, the means of making the pressing tool with which the guide bar was equipped press the wall of the measured plane in a quill hole and an opposite hand, and making it energize a guide bar and a measurement piece with a mirror to the measured plane side by it are taken.

[0006]

[Patent documents 1] JP,5-66512,U

[Description of the Invention]

[Problem(s) to be Solved by the Invention]

[0007]

However, although the straightness of the perpendicular direction of a device under test can be measured in such patent documents 1 to the device under test which has a measured plane in the perpendicular direction to a surface plate, measurement of the straightness of the perpendicular direction and the direction which goes direct is impossible.

[0008]

The purpose of this invention is to provide the straightness measuring apparatus which is stabilized and can measure a horizontal straightness to the vertical plane of a device under test.

[Means for Solving the Problem]

[0009]

This invention is characterized by that the state where a straightness measuring apparatus of this invention was laid on a surface plate comprises:

A slider which is a straightness measuring apparatus which measures a straightness of a device under test which has a measured plane which is a vertical plane which abbreviated-intersects perpendicularly to said top face of surface plate, and is extended to abbreviated parallel along said top face of surface plate, and has contact which is provided movable along a measured plane extending direction of said device under test, and contacts said measured plane.

A reflector which turned a reflector in the move direction of said slider, and was attached to said slider.

An autocollimator which ejects [of said slider] light from movement towards said reflector, and measures a straightness of said measured plane based on catoptric light from said reflector.

An energizing means which energizes said slider so that contact of said slider may touch said measured plane by a fixed pressure, and a support means contact of said slider supports said slider movable along a measured plane extending direction holding the state where said measured plane was touched.

[0010]

In such composition, a slider is horizontally moved to movement, i.e., a surface plate, along a measured plane of a device under test. In each movement zone, if detection light is turned to a reflector and ejected from an autocollimator, it is reflected by reflector, and since light is received by autocollimator, the light can measure a straightness of a measured plane of a device under test based on the catoptric light.

In this invention, since a slider is energized by energizing means so that contact of a slider may touch a measured plane by a fixed pressure, where a fixed pressure is always applied, a slider can be moved to a point of contact of contact of a slider, and a measured plane along a measured plane of a device under test by it. Therefore, since it can measure where a fixed pressure is always applied to a point of contact of contact of a slider, and a measured plane even if a measured plane is a vertical plane which abbreviated-intersects perpendicularly to a top face of surface plate, it is stabilized and a horizontal straightness of the measured plane can be measured with high precision.

And since a slider is supported by support means movable along a measured plane extending

direction in the state where it was held at the state where contact of a slider touched a measured plane, it is not necessary to enlarge energizing force by an energizing means. That is, since it is not necessary to enlarge contact pressure of contact of a slider, and a measured plane in order for contact of a slider to hold the state where a desired position of a measured plane was touched, also from this point, it is stabilized and a horizontal straightness of a measured plane can be measured with high precision.

[0011]

It is formed in shape which has a top piece which connects between a piece of a flank of said couple in a straightness measuring apparatus of this invention over a piece of a flank of a couple and the upper surface of a device under test in alignment with both side surfaces of a device under test, While said contact is formed in said one piece of a flank, it is preferred that said energizing means is provided in said contact of a piece of a flank of said another side and a position which counters.

According to this invention, since contact and an energizing means are arranged on both sides of a device under test in an opposed position, power which a slider rotates to a device under test does not occur. Therefore, a slider cannot incline during measuring work but it can measure by being stabilized.

[0012]

As for said measured plane of said device under test, in a straightness measuring apparatus of this invention, it is [said energizing means] preferred to be constituted by an air blow-off means which blows off air to an opposite side face.

Since an air blow-off means was used for an energizing means according to this invention and an energizing means and a device under test are non-contact, a factor of errors of measurement, such as friction, can be eliminated, and also damage to a member by contact, etc. can be prevented.

[0013]

It is preferred that said support means is established between a lower end part of said slider and a surface plate in a straightness measuring apparatus of this invention so that said slider may be held to said top face of surface plate in a prescribed height position.

According to this invention, by having a support means between a lower end part of a slider, and a surface plate, to a device under test, prudence of a slider can be prevented from starting, and load is not applied to a device under test, but a factor which lowers the accuracy of measurement, such as modification and damage, can be eliminated.

[0014]

As for said support means, in a straightness measuring apparatus of this invention, it is preferred to be constituted by an air blow-off means which blows off air to said top face of surface plate.

According to this invention, with constituting a support means by an air blow-off means, a surface plate and a support means can serve as non-contact via an air film, when moving a slider, friction cannot be induced between a surface plate and a support means, but the accuracy of measurement can be raised.

[Best Mode of Carrying Out the Invention]

[0015]

Hereafter, the embodiment of this invention is described based on a drawing.

The straightness measuring apparatus which measures the straightness of the straight edge ruler 3 which is a device under test is shown in drawing 1 - drawing 3.

In the state where it was laid via the spacer 2 on the surface plate 1, a section is rectangular frame shape, and the straight edge ruler 3 is formed in the hollow column shape extended to abbreviated parallel over the surface plate 1 upper surface, and equips one lateral surface of the rectangular cross section frame shape with the measured plane 31. The measured plane 31 is a vertical plane which abbreviated-intersects perpendicularly to the surface plate 1, and is extended to abbreviated parallel over the surface plate 1 upper surface.

[0016]

A straightness measuring apparatus is provided with the following.

The slider 4 which has contact 41 which is provided movable along measured plane 31 extending direction of the straight edge ruler 3, and contacts the measured plane 31.

The reflector 5 which turned the reflector in the move direction of the slider 4, and was attached to the slider 4.

The autocollimator 6 which ejects [of the slider 4] light from movement towards the reflector 5, and measures the straightness of the measured plane 31 based on the catoptric light from the reflector 5.

The energizing means 7 which energizes the slider 4 so that contact 41 of the slider 4 may touch the measured plane 31 by a fixed pressure, and the support means 8 contact 41 of the slider 4 supports the slider 4 movable along the extending direction of the measured plane 31 holding the state where the measured plane 31 was touched.

[0017]

The slider 4 is provided with the following.

The pieces 42A and 42B of a flank of the couple in alignment with the both side surfaces of the straight edge ruler 3.

The top piece 43 which connects between the piece 42A of a flank of a couple, and 42B over the upper surface of straight edge ruler.

The piece 44 of a pars basilaris ossis occipitalis bent in parallel [with the surface plate 1] right-angled outside from the end of the piece 42A of a flank.

Two hemispherical contact 41 constant-interval-separates, and is provided in the extending direction of the measured plane 31 at the inner surface side of the piece 42A of a flank.

[0018]

The reflector 5 is provided with the following.

The mirror 51 which has a mirror surface part.

The mounting part 52 for attaching the mirror 51 to the slider 4.

The mirror 51 is attached to the abbreviated mid-position of two contact 41 at the outside surface side of the piece 42A of a flank.

[0019]

The autocollimator 6 is arranged at the mirror 51 and the position which counters, ejects detection light from an outputting part (graphic display abbreviation) towards the mirror 51, receives the catoptric light from the mirror 51 in a primary detecting element (graphic display abbreviation), and asks for the straightness of the measured plane 31.

[0020]

The energizing means 7 is provided with the following.

The adjusting screw 71 screwed in the piece 42B of a flank.

Spherical bearing 72 provided at the tip of the adjusting screw 71.

The air bearing 73 for energization attached to the adjusting screw 71 rockable via the spherical bearing 72.

The air bearing 73 for energization is provided with the following.

Cylinder 74.

The piston 75 stored by this cylinder 74 via the piston ring 76 so that sliding was possible.

While compressed air is accumulated in the chamber 77 formed between the cylinder 74 and the piston 75, the air jetting hole (graphic display abbreviation) is formed in the opposed face with the straight edge ruler 3 of the cylinder 74. Thereby, the compressed air in the chamber 77 blows off from an air jetting hole towards the straight edge ruler 3, and the air film is formed between the straight edge rulers 3.

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TECHNICAL FIELD

[Field of the Invention]
[0001]
This invention relates to a straightness measuring apparatus.

[Translation done.]

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PRIOR ART

[Background of the Invention]
[0002]
A measuring plane is used with two horizontal and vertical postures, and straight edge ruler is used for the check of the finishing accuracy of the machined work, and geometric movement accuracy, such as a machine tool, as a straightness standard in the level surface and a vertical plane.
Since the straightnesses of a measuring plane differ by the case where they are a case where the measuring plane of straight edge ruler is a horizontal position, and a vertical attitude, in that case, in order to use as a stricter standard to high degree of accuracy, it is necessary to make a market a straightness for every posture.
[0003]
Conventionally, when a measuring plane is a horizontal position, the straightness is measured by the measuring method shown in drawing 4. The straight edge ruler 93 is laid via the spacer 92 on the surface plate 91, and the slider 96 which has two contact 95 in contact with the measuring plane (that is, measured plane 94) in the upper surface side of this straight edge ruler 93 is formed in the direction which intersects perpendicularly with the space of drawing 4 along the measured plane 94 movable. Detection light is ejected from the reflector 97 attached on the slider 96, and the autocollimator (graphic display abbreviation) arranged at the position which counters to the reflector 97, and the straightness of the measured plane 94 is measured based on the catoptric light from the reflector 97.
Since contact 95 is forced on the measured plane 94 by prudence of the slider 96 with constant pressure for the composition which laid the slider 96 movable on the measured plane 94 in the case of this measuring method, stable measurement can be performed.
[0004]
When a measuring plane is a vertical attitude, the straightness is measured by the measuring

method shown in drawing 5. The straightness of the measured plane 94 is measured by the same method as the above-mentioned, making contact 95 of the slider 96 contact the perpendicular measuring plane (that is, measured plane 94) of the straight edge ruler 93, and moving the slider 96 along the measured plane 94 in this state.

In order to have to measure in the case of this measuring method, forcing the slider 96 on the measured plane 94 of the straight edge ruler 93, the contact pressure of the measured plane 94 and contact 95 was easily changed according to pressure, and since it was a non-controlled state, it was difficult to perform stable measurement.

[0005]

By the way, the vertical mold straightness measuring apparatus is proposed as a device for measuring the straightness of the measuring hole provided in the perpendicular direction (for example, patent documents 1).

In a device given in these patent documents 1, the measurement piece with a mirror hung from the upper part with the wire from a quill hole with the cylindrical shape of mist or a byway. The portion which inserts a measurement piece with a mirror inserting in a quill hole together with the guide bar which lacks in the approximately U shape, ejecting the detection light by an autocollimator from the upper part to a measurement piece with a mirror, and detecting the catoptric light from a mirror. You make it go up and down a measurement piece with a mirror on the measured plane in a quill hole, and a straightness is measured. Under the present circumstances, in order to stick a measurement piece with a mirror to a measured plane, the means of making the pressing tool with which the guide bar was equipped press the wall of the measured plane in a quill hole and an opposite hand, and making it energize a guide bar and a measurement piece with a mirror to the measured plane side by it are taken.

[0006]

[Patent documents 1] JP,5-66512,U

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]

[0007]

However, although the straightness of the perpendicular direction of a device under test can be measured in such patent documents 1 to the device under test which has a measured plane in the perpendicular direction to a surface plate, measurement of the straightness of the perpendicular direction and the direction which goes direct is impossible.

[0008]

The purpose of this invention is to provide the straightness measuring apparatus which is stabilized and can measure a horizontal straightness to the vertical plane of a device under test.

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MEANS

[Means for Solving the Problem]
[0009]
This invention is characterized by that the state where a straightness measuring apparatus of this invention was laid on a surface plate comprises:
A slider which is a straightness measuring apparatus which measures a straightness of a device under test which has a measured plane which is a vertical plane which abbreviated-intersects perpendicularly to said top face of surface plate, and is extended to abbreviated parallel along said top face of surface plate, and has contact which is provided movable along a measured plane extending direction of said device under test, and contacts said measured plane.
A reflector which turned a reflector in the move direction of said slider, and was attached to said slider.
An autocollimator which ejects [of said slider] light from movement towards said reflector, and measures a straightness of said measured plane based on catoptric light from said reflector.
An energizing means which energizes said slider so that contact of said slider may touch said measured plane by a fixed pressure, and a support means contact of said slider supports said slider movable along a measured plane extending direction holding the state where said measured plane was touched.

[0010]
In such composition, a slider is horizontally moved to movement, i.e., a surface plate, along a measured plane of a device under test. In each movement zone, if detection light is turned to a reflector and ejected from an autocollimator, it is reflected by reflector, and since light is received by autocollimator, the light can measure a straightness of a measured plane of a device under test based on the catoptric light.

In this invention, since a slider is energized by energizing means so that contact of a slider may touch a measured plane by a fixed pressure, where a fixed pressure is always applied, a slider can be moved to a point of contact of contact of a slider, and a measured plane along a measured plane of a device under test by it. Therefore, since it can measure where a fixed pressure is always applied to a point of contact of contact of a slider, and a measured plane even if a measured plane is a vertical plane which abbreviated-intersects perpendicularly to a top face of surface plate, it is stabilized and a horizontal straightness of the measured plane can be measured with high precision.

And since a slider is supported by support means movable along a measured plane extending direction in the state where it was held at the state where contact of a slider touched a measured plane, it is not necessary to enlarge energizing force by an energizing means. That is, since it is not necessary to enlarge contact pressure of contact of a slider, and a measured plane in order for contact of a slider to hold the state where a desired position of a measured plane was touched, also from this point, it is stabilized and a horizontal straightness of a measured plane can be measured with high precision.

[0011]

It is formed in shape which has a top piece which connects between a piece of a flank of said couple in a straightness measuring apparatus of this invention over a piece of a flank of a couple and the upper surface of a device under test in alignment with both side surfaces of a device under test, While said contact is formed in said one piece of a flank, it is preferred that said energizing means is provided in said contact of a piece of a flank of said another side and a position which counters.

According to this invention, since contact and an energizing means are arranged on both sides of a device under test in an opposed position, power which a slider rotates to a device under test does not occur. Therefore, a slider cannot incline during measuring work but it can measure by being stabilized.

[0012]

As for said measured plane of said device under test, in a straightness measuring apparatus of this invention, it is [said energizing means] preferred to be constituted by an air blow-off means which blows off air to an opposite side face.

Since an air blow-off means was used for an energizing means according to this invention and an energizing means and a device under test are non-contact, a factor of errors of measurement, such as friction, can be eliminated, and also damage to a member by contact, etc. can be prevented.

[0013]

It is preferred that said support means is established between a lower end part of said slider and a surface plate in a straightness measuring apparatus of this invention so that said slider

may be held to said top face of surface plate in a prescribed height position.
According to this invention, by having a support means between a lower end part of a slider, and a surface plate, to a device under test, prudence of a slider can be prevented from starting, and load is not applied to a device under test, but a factor which lowers the accuracy of measurement, such as modification and damage, can be eliminated.
[0014]
As for said support means, in a straightness measuring apparatus of this invention, it is preferred to be constituted by an air blow-off means which blows off air to said top face of surface plate.
According to this invention, with constituting a support means by an air blow-off means, a surface plate and a support means can serve as non-contact via an air film, when moving a slider, friction cannot be induced between a surface plate and a support means, but the accuracy of measurement can be raised.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[0033]
[Drawing 1]It is the general drawing showing the embodiment of this invention.
[Drawing 2]It is a side view showing the embodiment of this invention.
[Drawing 3]It is an III-III line sectional view in drawing 1.
[Drawing 4]It is a figure showing the measuring method (measuring method of a level thing) of conventional technology.
[Drawing 5]It is a figure showing the measuring method (measuring method of a vertical plane) of conventional technology.

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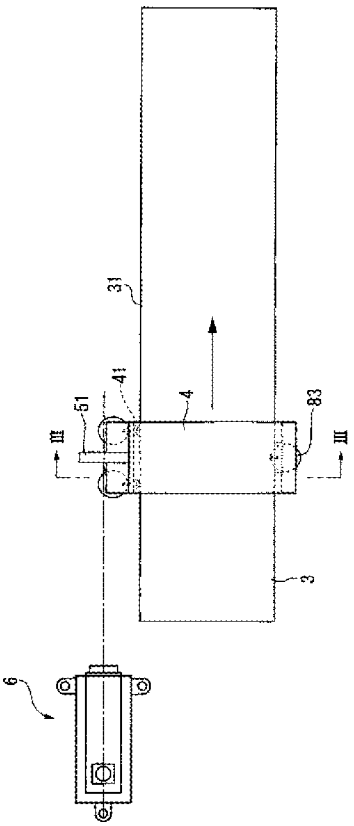
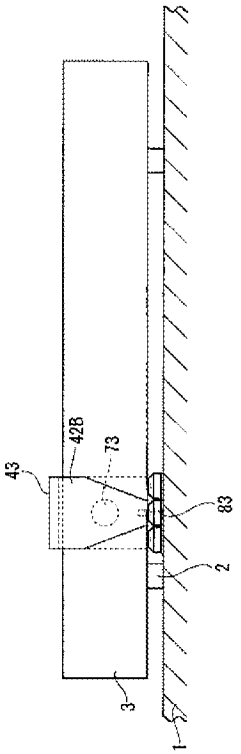
DRAWINGS

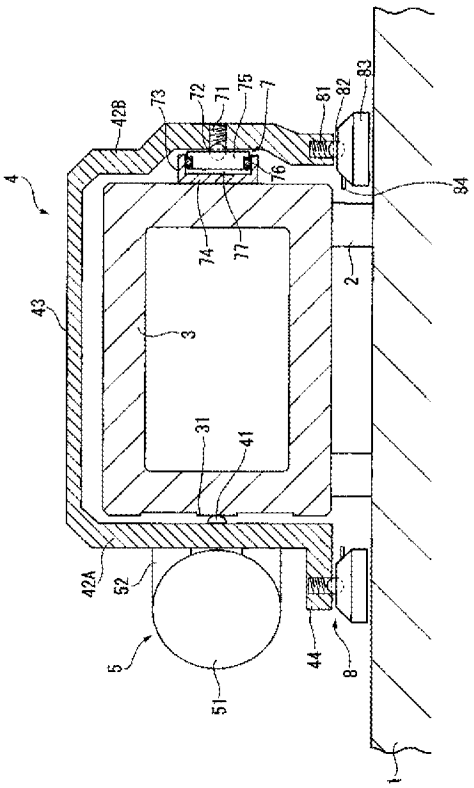
[Drawing 1]



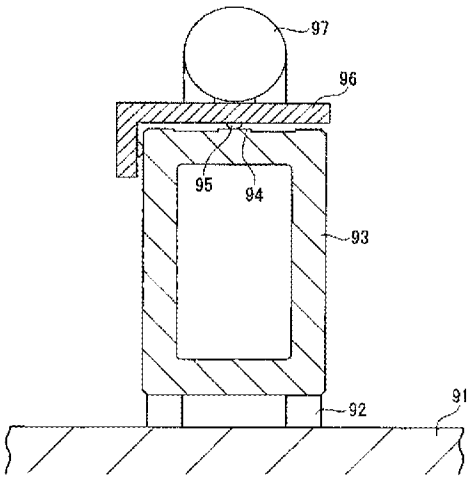
[Drawing 2]



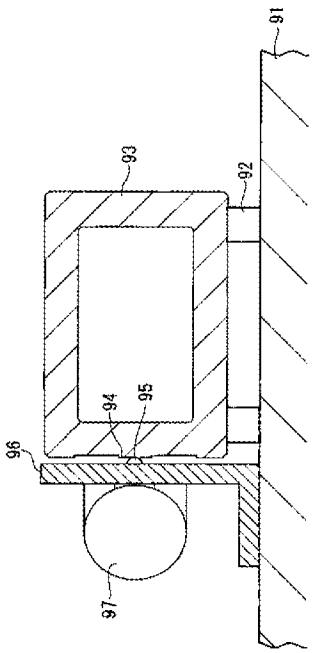
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]